May 25, 1995 F/AKC1:TH

PRELIMINARY CRUISE RESULTS

NOAA SHIP MILLER FREEMAN, CRUISE NO. 95-02
ECHO INTEGRATION-TRAWL SURVEY OF THE SOUTHEASTERN ALEUTIAN BASIN NEAR BOGOSLOF ISLAND

CRUISE PERIOD, AREA, AND SCHEDULE

Scientists from the Alaska Fisheries Science Center (AFSC) conducted an echo integration-trawl (EIT) survey of walleye pollock (Theragra chalcogramma) aboard the NOAA ship Miller Freeman from February 24, to March 9, 1995. The cruise began and ended in Dutch Harbor, Alaska. The survey area encompassed Aleutian Basin waters near Bogoslof Island from north of Akutan Island westward to Amukta Pass.

The vessel's itinerary was as follows:

Feb 24	Embark scientists in Dutch Harbor, Alaska
Feb 25	Depart Dutch Harbor
Feb 25-Mar 8	EIT survey of the Bogoslof Island region; Amukta Pass conductivity-temperature-depth (CTD) work
Mar 8	Sphere calibration in Makushin Bay
Mar 9	Arrive Dutch Harbor

The primary objective of the cruise was to collect echo integration data and midwater and demersal trawl data necessary to determine the distribution, biomass, and biological composition of walleye pollock in the southeastern Aleutian Basin near Bogoslof Island.

Other objectives of the cruise were to collect and preserve whole stomachs from pollock, to spawn mature pollock, and culture the fertilized eggs for laboratory experiments on larval pollock growth rate and development, to collect mature pollock ovaries

for fecundity studies, and to calibrate the acoustic data collection system. A series of four CTDs was conducted in Amukta Pass to continue the acquisition of long-term, oceanographic, time-series data for Pacific Marine Environmental Laboratory (PMEL)/Fisheries Oceanography Coordinated Investigations (FOCI) joint projects. Throughout the cruise, meteorological and physical oceanographic data were collected, including temperature and salinity profiles at selected sites. Near surface currents, temperature, salinity, and light levels were continuously monitored.

VESSEL, ACOUSTIC EQUIPMENT, AND TRAWL GEAR

The survey was conducted on board the NOAA ship Miller Freeman, a 66-m (216-ft) stern trawler equipped for fisheries and oceanographic research. Acoustic data were collected with a quantitative echo-sounding system (Simrad EK500[1]). Simrad 38 kHz and 120 kHz split-beam transducers were mounted on the distal end of the vessel's centerboard. The 38 kHz was the primary data collection transducer. With the centerboard fully extended, the transducers were 9 m below the water's surface. System electronics were housed in a portable laboratory mounted on the vessel's weather deck. Data from the Simrad EK500 echo sounder/receiver were processed using Simrad BI500 echo integration and target strength data analysis software on a SUN workstation.

Midwater echo-sign was sampled using a modified Northern Gold 1200 midwater rope trawl (NET Systems, Inc.). The trawl was constructed with ropes in the forward section and stretch mesh sizes ranging from 163 cm (64 in) immediately behind the rope section to 8.9 cm (3.5 in) in the codend. It was fished in a bridleless configuration and was fitted with a 3.2-cm (1.25-in) mesh codend liner. Headrope and footrope lengths were 94.5 m (310 ft) and 50 m (164 ft), respectively, and the breastlines measured 79.4 m (260.5 ft). The headrope length was measured between the points of attachment to the breastline. The footrope length was measured between the points where the tom weights are attached. The net was fished with 1.8-m X 2.7-m (6-ft X 9-ft) steel V-doors [1,000 kg (2,200 lb)] and 227-kg (500-lb) tom weights on each side. Vertical net opening and depth were monitored with a Furuno wireless netsounder system attached to the headrope of the trawl.

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[1] Reference to trade names or commercial firms does not constitute U.S. Government endorsement.

Fish on and near bottom were sampled with a polyethylene Nor'eastern high-opening bottom trawl equipped with roller gear. The trawl was constructed with stretch mesh sizes that ranged from 13 cm (5 in) in the forward portion of the net to 8.9 cm (3.5 in) in the codend. It was fitted with a nylon codend liner with a mesh size of 3.2 cm (1.25 in). The 27.2-m (89.1-ft) headrope held 21 floats [30 cm (12 in) diameter]. A 24.7-m (81-ft) chain fishing line was attached to the 24.9-m (81.6-ft) footrope which was constructed of 1-cm (0.4-in) 6 x 19 wire rope wrapped with polypropylene rope. The 24.2-m (79.5-ft) roller gear was constructed with 36-cm (14-in) rubber bobbins spaced 1.5 m-2.1 m (5 ft-7 ft) apart. A solid string of 10-cm (4-in) rubber disks separated some of the bobbins in the center section of the roller gear. Two 5.9-m (19.5-ft) wire rope extensions with 10-cm (4-in) and 20-cm (8-in) rubber disks were used to span the two lower flying wing sections and were attached to the roller gear. The roller gear was attached to the fishing line using chain toggles [2.9 kg (6.5 lb) each] which were comprised of five links and one ring. The trawl was rigged with triple 54.9-m (180-ft) galvanized wire rope dandylines. The net was fished with 1.8-m X 2.7-m (6-ft X 9-ft) steel V-doors, [1,000-kg (2,200-lb)]. Vertical net opening and depth were monitored with a Furuno wireless net sounder system attached to the headrope of the trawl.

A Methot trawl and a bongo net were used to sample micronekton and macrozooplankton at two sampling sites, respectively. The mouth of the Methot was a square frame measuring 2.27 m (89.5 in) on each side. Mesh size was 2 mm X 3 mm (0.08 in X 0.12 in) in the main part of the net, and 1 mm (0.04 in) in the codend. A 1.83-m (6-ft) dihedral depressor modified from an Isaacs-Kidd midwater trawl was used. The Methot was not fished with steel V-doors. Instead, it was attached by a single cable fed through a stern-mounted A-frame. Tow depth profile for the Methot trawl was obtained by attaching a microBT (small, retrievable temperature profiler) to the frame. The bongo net system consisted of a 60 cm (23.6 in) bongo frame with 333 ?m mesh nets. A 40 kg lead weight was used as a depressor. To monitor depth and oceanographic conditions, a Seabird CTD profiler was attached to the wire about 0.6 m above the bongo frame.

Water temperature and salinity profile data were collected at trawl and calibration sites with a Seabird CTD system. Additional temperature profile data were obtained by launching an expendable bathythermograph (XBT) and by attaching microBTs to most trawls. Sea surface oceanographic data and environmental data were collected using the NOAA ship Miller Freeman's Scientific Collection System (SCS). Ocean current profile data were

provided by the vessel's acoustic Doppler current profiler system whose transducer is mounted in the centerboard.

SURVEY METHODS

Four standard sphere calibrations were conducted in conjunction with the survey (Table 1). Two were completed before the cruise began, on January 26 in Puget Sound, Washington and on February 13 in Ugak Bay, Kodiak Island, Alaska. The third and fourth calibrations were completed at the end of the cruise on March 8, in Skan Bay, and on April 13, in Anderson Bay, Unalaska Island, Alaska. For the 38 kHz transducer, the main data collection system, no significant differences in the acoustic system parameters were observed between the four calibrations. The 120 kHz transducer experienced some acoustic parameter changes between the first, second and third calibrations. The SV gain for the 120 kHz dropped from 25.1 to 24.1, and the TS gain dropped from 24.9 to 24.1 (Table 1). Between the third and fourth calibration no further acoustic parameter differences occurred. During the Bogoslof area survey, both the 120 kHz and the 38 kHz acoustic systems were operated with February 13 calibration settings.

The Bogoslof Island area survey began in late afternoon on February 25 and ended the morning of March 9. Two EIT survey passes were conducted through the main Bogoslof spawning area covering a total of 1,782 nmi of transects, including transit to and from Amukta Pass. The trackline for pass 1 consisted of north-south transects beginning at 165° 51'W long. westward to 170° 53'W long. (Fig. 1). Transect spacing at the eastern and western ends of the survey area was 10 nautical miles (nmi). In the central survey area where pollock densities were higher, transect spacing was decreased to 5 nmi. The southern transect endpoints were at about 100 m bottom depth on the Aleutian shelf. The northern extent of the transects was similar to that on previous winter surveys in the Bogoslof region, between 54°00' and 54°30'N lat. Because winter 1994 Domestic Observer Program data indicated that there had been a substantial amount of pollock fishing in early March, 1994, at around 170° W long., the 1995 survey area was extended farther west than in previous years. During pass 2, parallel tracklines oriented north-south and spaced at 5 nmi were conducted from 169°15'W long. eastward to about 164°38'W long. (Fig.2). The southern boundaries of pass 2 were similar to those from pass 1, whereas northern transect boundaries were shifted slightly to the south.

EIT survey operations were conducted both day and night. While conducting transects, the vessel maintained speeds ranging between 7 and 12 kts, depending upon weather conditions. The acoustic system collected echo integration data continuously along the transects. After being properly scaled, these data were used to provide estimates of pollock density. Midwater trawl hauls were made at selected locations to identify echo sign and provide biological samples. The average trawling speed was about 3 kts. The vertical opening for the midwater rope trawl averaged about 23 m. Standard catch sorting and biological sampling procedures were used to provide weight and number by species for each haul. Pollock were further sampled to determine sex, length, body weight, age, maturity, and ovary weight. Ovary tissue samples were collected from mature (pre-spawning) females and preserved in Gilson's solution for fecundity studies. Pollock stomachs were collected and preserved in formalin for food habits studies.

Between survey passes 1 and 2, a series of four CTDs were conducted in Amukta Pass. Procedures for conducting these CTD casts were the same as those used for FOCI cruises. CTD descent rate was 30 m/min for the first 200 m and then increased to 45 m/min below that depth. The ascent rate was 50 m/min. For sensor quality assurance, a salinity sample was collected at the bottom of each cast.

PRELIMINARY RESULTS

Biological data were collected and specimen and tissue samples preserved from catches of 17 midwater rope trawls, one bottom trawl, one Methot trawl, and one bongo net tow (Figs. 3 and 4, Tables 2 and 3). Pollock dominated the midwater and bottom trawl catches in both weight and numbers (Tables 4 and 5). Significant numbers of lanternfish (Myctophidae) and northern smoothtongues (Leuroglossus schmidti) were also captured. Euphausiids and a Pacific lamprey accounted for most of the Methot trawl catch by weight (Table 6). With the exception of the Methot trawl and bongo net tow, the distribution of biological samples was fairly even between hauls (Table 7).

Oceanographic data were collected from 15 CTD casts, 1 XBT cast, and 18 microBT casts (Tables 8-10). Temperature and salinity profiles showed a fairly well mixed water column with temperatures close to 3.5° C between 0 and 700 m depth (Fig. 5). Near-surface water was a little cooler (3° C) on the eastern Bering Sea shelf side of the survey area, and a little warmer on the western (Aleutian Basin) side (4° C). Salinity increased

with depth from about 32.5 ppt at the surface to 34 ppt at depths below 500 m.

Pollock echo sign was observed throughout the survey area. Isolated high density aggregations were encountered off the edge of the shelf north of Akutan Island and over deep water northeast of Bogoslof Island. Most of the high density pollock schools were observed along the north side of Umnak Island from 168^{0}W long. to 169^{0}30'W long.(Figs. 1 and 2). The largest pollock aggregations, centered north and west of Umnak Island, were somewhat west of where they had been observed in previous years. The vertical distribution of pollock echo sign ranged from 250 m to 750 m below the surface.

Although pollock caught during the survey had fork lengths (FL) ranging from 10 to 68 cm, the majority were between 40-60 cm FL (Fig. 6). With the exception of several young pollock we estimated to be age 1's, very few fish with FL less than 34 cm were encountered. Hauls 1, 3, and 5, which were close to the shelf in the eastern portion of the survey area, had fish of shorter average FL than the other hauls. Data from all 17 midwater rope trawls showed that the sex ratio by haul ranged from 8% to 94% female, and averaged around 60% female. During previous Bogoslof area surveys (see unpublished cruise reports MF94-1, MF94-2), observations from paired midwater tows on shallow and deep echo sign layers have shown that the proportion of males captured is higher in deeper layers, implying that vertical stratification by sex occurs. In 1995, midwater trawl data indicate that male pollock usually inhabit deeper layers in the water column than females. Of the 17 rope trawls, the three deepest (haul 3 at 497 m, haul 15 at 545 m and haul 12 at 722 m) caught only 17%, 25%, and 8% females, respectively.

Maturity composition for female pollock 38 cm to 69 cm FL indicated that 5% were in a developing stage and not expected to spawn soon, 80% were in a pre-spawning stage, 8% were actively spawning, and 7% were post-spawning (Fig. 7). Haul 1 had the highest proportion of developing stage females compared to the rest of the hauls. The mean gonadosomatic index (GSI), defined as the ratio of gonad weight to total body weight for pre-spawning females, was 0.19 (Fig. 8).

SCIENTIFIC PERSONNEL

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